

Whatever proposal the industry develops, there are some steps the Commission could adopt presently that would minimize potential abuses and smooth the process of clearing spectrum in the unlicensed bands. Northern Telecom suggests that to accommodate these particular point-to-point users in the unlicensed PCS bands, they should be given priority access to government spectrum or other 2 GHz spectrum if they cannot be accommodated in higher bands. Northern Telecom recognizes there may be a need to compensate the existing users, but suggests that the compensation not exceed the depreciated value, including engineering and installation costs, of the existing equipment. In addition, license application fees for the new assignments should be waived, and the level of compensation provided to the relocated point-to-point licensees should be reduced by any remuneration received through such incentive mechanisms as tax certificates. Under no circumstances should compensation for the future commercial value of the vacated spectrum be required.

D. Additional Technical Considerations With  
Respect to Unlicensed Applications.

Northern Telecom strongly supports the Commission's proposal to allocate spectrum to the unlicensed PCS activities because of the valuable services that will become available, and because of the potential for unlicensed operations to serve as a catalyst for the widespread deployment of PCS. Northern Telecom, however, urges the Commission to allocate additional spectrum to

unlicensed PCS services. The proposed allocation of 20 MHz, while providing a basis for the initial deployment of voice, data and potential other services, will be insufficient for these applications within a relatively short period of time. For example, some data applications will require 10 MHz channels. If the band is to be shared with narrowband applications, it appears that only one broadband system could operate in a location at any one time.<sup>15/</sup> While it will be possible for some early deployment of unlicensed PCS applications to occur in the 20 MHz proposed by the Commission, the constraints imposed by spectrum limitations on broadband uses will hamper deployment, competition and innovation in the longer term for these applications.

Similarly, narrowband systems for business applications for voice and related uses are expected to use 4 to 5 MHz per system, whether in multiple narrowband (100 kHz) channels or fewer wideband channels (around 1 MHz). While we strongly urge the use of CAIs across vendors for these types of applications, there is a possibility that such an interface is not fully developed (or will not have completed the formal standards approval process), creating the possibility of non-standard interfaces.<sup>16/</sup> As a result, sharing between different

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<sup>15/</sup> A detailed investigation and modelling of this issue by WinForum contributor Don Johnson of NCR demonstrated that the exclusion zone for two broadband systems is in the order of 100 meters.

<sup>16/</sup> Of course, one of the valuable features of the Spectrum Management Methodology proposed by Northern Telecom is the  
(continued...)

manufacturers' systems could be constrained. Thus, in light of the limited capacity for sharing with only one broadband (10 MHz) data system, it is possible that only two fully built out narrowband business systems could operate properly in the same office complex. Alternatively, additional systems could co-exist, but with degradations in capacity and quality. Particularly in commercial applications, if the PCS technologies are unreliable or of inferior quality because of interference problems, users are unlikely to deploy PCS technologies. Northern Telecom believes that in order to be successful, the service quality and availability standards for unlicensed PCS must be the same as those for wireline data and voice applications.<sup>17/</sup>

Thus, quality or availability problems resulting from there being only 20 MHz of unlicensed spectrum are likely to

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<sup>16/</sup>(...continued)  
ability to accommodate different CAIs, and to incorporate refinements (or significant changes) to the CAIs as they evolve over time.

<sup>17/</sup> Unlike cellular and licensed PCS operations, where there are a limited number of operators making use of the allocated spectrum (two for cellular, and a proposal for three for PCS), the open access of unlicensed PCS operations means that there will be an unlimited number of operators contending for use of the spectrum, and they will be seeking to use the spectrum for a wide variety of uses (e.g., voice, wideband data, narrowband data), potentially using multiple technologies and interfaces. In addition, because of the absence of charges for air time, there is expected to be intensive usage with little incentive to control air time. All of these factors suggest that particularly when contrasted with the allocations for cellular (50 MHz) and licensed PCS (proposed allocation of 90 MHz), the 20 MHz proposed to be allocated to unlicensed PCS activities will be inadequate.

stifle demand for service, and hence demand for multiple coexisting wireless systems for different applications that would lead to competition in what should be a dynamic market environment. Therefore, Northern Telecom recommends an initial allocation of 35 MHz for the unlicensed band. The allocation would include the 20 MHz of spectrum currently proposed by the Commission, along with 15 MHz in the adjacent frequencies of 1895 MHz to 1910 MHz for additional unlicensed applications.

As indicated previously, "clear" spectrum is necessary for ubiquitous, fully mobile unlicensed PCS operations. Northern Telecom recognizes, however, that it may be difficult to relocate all of the point-to-point licensees from the unlicensed bands at once. Northern Telecom suggests that as portions of the bands become clear, and for specific applications in some territories, unlicensed operations could begin in those segments. Such a "phased" implementation takes into account the ease and economics of clearing specific parts of the band in particular geographic areas, while preventing overall delay in deployment of unlicensed PCS. It is important, however, for the Commission to allocate the entire 35 MHz immediately, to ensure that equipment is designed to be able to operate throughout the 35 MHz (although actual operations at any time would be restricted to the "clear" spectrum).

It is imperative, however, that the spectrum initially allocated and cleared for unlicensed PCS operations be channelized. As Northern Telecom and WinForum recognize, the

demand for that spectrum from wideband, medium band and narrowband uses will exceed the available supply. Failure to specify channelization presents a real danger of a spectrum squeeze caused by a "first-in-takes-all" stampede. In contrast, a well-crafted channelization scheme, such as the one proposed by the Commission, will provide the manufacturers the confidence to invest in developing the necessary products. Northern Telecom therefore supports the channelization plan proposed by the Commission for the initial 20 MHz of spectrum for unlicensed PCS applications, with 10 MHz set aside for broadband, 5 MHz for medium band, and 5 MHz set aside for narrowband uses.

WinForum has recognized both the variety of capabilities proposed by its members and the exceptionally severe constraints imposed by only 20 MHz of spectrum. This industry forum has been exploring a variety of channelization proposals that would allow a greater variety of applications to access and share the entire proposed allocation of spectrum. The work is progressing, but it has not concluded. Northern Telecom recommends that the Commission monitor these channelization efforts of the industry, which may provide a means for more effective use of the unlicensed bands, thus facilitating a "phased" implementation and delaying at least for some time the exhaustion of the proposed allocation for unlicensed PCS applications.

A final technical issue regarding unlicensed PCS operations is the need for the Commission to develop rules

governing the equipment. Northern Telecom suggests that the equipment be fully type-approved to ensure compliance with the unlicensed band restrictions, and to provide equitable spectrum use. Northern Telecom also strongly recommends that the equipment for unlicensed PCS operations use the same CAI used by PCS operators in the licensed bands. Such a requirement will ensure PCS ubiquity and interoperability across multiple PCS applications. In addition, because equipment is likely to be deployed in the unlicensed band earlier, licensed PCS operators will have a ready-made customer base to which they can market. As a result of the familiarity with PCS acquired through unlicensed uses, these customers are likely to also use the licensed service, generating early revenue streams to support the costs of building the infrastructure. In this manner, unlicensed PCS services can serve as an important catalyst for the widespread deployment of PCS.

III.        THE FORM OF REGULATION WILL AFFECT THE SUCCESS  
OF PCS IN MEETING THE COMMISSION'S GOAL OF THE  
WIDEST RANGE OF SERVICES AT THE LOWEST COST

A.        Licensed PCS Providers Must Be Classified  
As Common Carriers To Provide The Services  
Their Customers Will Require

In the NPRM, the Commission seeks comment on whether PCS should be classified as a common carrier or private land mobile radio service.<sup>18/</sup> Common carrier classification has

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<sup>18/</sup>        NPRM at ¶ 95.

benefits to the PCS subscribers. Common carrier classification ensures that nondiscriminatory access is available to all members of the public. In addition, one of the goals of the Commission should be a PCS that serves as part of a seamless network with the public switched networks. Full interconnection of wired and wireless networks would not be possible if PCS was classified as a private land mobile service, however, because Section 332 of the Communications Act restricts the ability of a private land mobile service to interconnect with, interact with, and jointly develop the telephone exchange or interexchange service or facility.

A common carrier classification for PCS would also eliminate problems arising from inconsistent regulations for PCS and other wireless mobile carriers such as cellular, who provide competitive services (and who may be allowed to provide PCS services over their cellular spectrum). It would be confusing, and potentially disruptive to competition, to classify nearly identical services differently for regulatory purposes, particularly where the classifications have potentially significant consequences. Depending on the form of regulation applied to common carrier activities, those operators could be at a competitive disadvantage if, for example, they were required to file tariffs for their services, which would limit their ability to react quickly in implementing price or service innovations. Such a competitive difference could result from the asymmetrical preemption of state regulation afforded to private land mobile

services. Thus, the Commission's goal of a competitive, ubiquitous PCS interconnected with wired networks would best be served by common carrier classification.

The Commission is concerned that interconnection regulations by the state and local governments could impede the development of interstate PCS service. Therefore, it

tentatively conclude[s] that the kinds of PCS interconnection with the PSTN should, in most cases, be determined at the federal level. We also tentatively conclude that state and local regulation of the kinds of interconnection to which PCS providers are entitled should be preempted.<sup>19/</sup>

Northern Telecom supports the Commission's view of preemption of state interconnection regulation, and urges the Commission to adopt federal interconnection policies that will ensure that free market forces play the largest part in the success of this service. PCS services are expected to encounter significant competition from cellular, SMR, and other future wireless services. Northern Telecom believes that excessive regulation would stifle innovation, and increase service costs resulting in reduced demand. Although Northern Telecom supports classification as common carriers, we urge the Commission to apply minimal regulation because of the high level of competition each PCS operator will face.

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<sup>19/</sup> NPRM at ¶ 103.



B. Fair Connection Into The Public Switched Telephone Network Is Crucial To The Success Of PCS

The Commission requests comment on how the PCS providers will connect with the public switched telephone networks (PSTN). The Commission proposes to confirm explicitly that PCS licensees have a federally protected right to interconnection with the PSTN.<sup>20/</sup> Northern Telecom strongly supports the Commission on this point. Interconnection and interoperability are key capabilities of PCS mobility. The user must see a seamless access to services regardless of geographic location if the applicants are to be successful. However, absent amendment of Section 332 of the Communications Act, such interconnection is incompatible with classification of PCS as private land mobile service.

The Commission also asks whether PCS providers should be entitled to obtain a type of interconnection that is "reasonable for the particular PCS system and no less favorable than that offered by the LEC to any other customer or carrier."<sup>21/</sup> Northern Telecom supports the Commission in its efforts to provide the PCS licensees the right to interconnect with the PSTN in a fair and equitable manner. Interconnection should be flexible to take advantage of new technologies that will become available in the future, and priced

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<sup>20/</sup> NPRM at ¶ 99.

<sup>21/</sup> NPRM at ¶ 101.

nondiscriminatorily to enable the PCS licensees compete in the marketplace. Without the ability to connect into the PSTN, PCS providers would not be able to offer the services their customers will require. However, the carriers should be compensated for interconnection services at a level that allows them to recover the costs of those services, including a reasonable return to their investors.

IV. CELLULAR COMPANIES AND LOCAL EXCHANGE  
CARRIERS CAN INCREASE COMPETITION IN  
THE WIRELESS SERVICES MARKET, AND PROVIDE  
PCS SERVICES IN A COST EFFECTIVE MANNER

A. Cellular Companies Have Significant Experience  
In Providing Wireless Communications And Should  
Be Able To Offer PCS Outside Their Service Area

In the NPRM, the Commission proposes to allow cellular providers to obtain PCS spectrum licenses outside of their cellular service areas.<sup>22/</sup> Northern Telecom believes that the competition between PCS providers and cellular operators will benefit the users of both wireless services. Multiple providers will force suppliers to provide additional services to their customers at competitive prices. While Northern Telecom acknowledges the arguments of the parties seeking to foster such "interservice" competition by limiting the ability of a cellular carrier to obtain a PCS license within its cellular service territory, there are no good reasons to prevent cellular carriers

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<sup>22/</sup> NPRM at ¶ 67.

from obtaining a PCS license outside their territory. Indeed, allowing cellular companies into the PCS market place will enable them to take advantage of years of experience, technical knowledge and existing billing systems. This will ensure PCS services can be offered at competitive prices early in the market life, and will increase demand for the services. Northern Telecom strongly supports the Commission allowing the cellular companies access to licensed PCS spectrum outside their service areas.

B.     Allowing Cellular Companies To Offer  
        PCS-Type Services On Their Current Spectrum  
        Will Promote Competition In Service Areas

The Commission asks whether rules covering cellular service should be liberalized to allow the cellular companies to take better advantage of their existing frequencies, and, more explicitly, proposes to allow cellular carriers the right to provide PCS-type services.<sup>23/</sup> The benefits of competition are severely diminished when some of the competitors are artificially handicapped by the regulators. Cellular carriers should not have to face stiff "interservice" competition from PCS services, without the ability themselves to provide PCS-type services, solely as a result of government regulation. Northern Telecom believes the Commission should seek to enhance competition and "level the playing field," which in turn will benefit the

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<sup>23/</sup>     NPRM at ¶¶ 69-70.

consumer. Therefore, Northern Telecom supports the Commission proposal to amend its cellular service rules to permit cellular carriers to provide PCS services in the cellular spectrum.

Northern Telecom specifically supports the amendment of Section 22.930 of the Commission's Rules to allow cellular companies to provide wireless PBX and other similar services in the cellular bands, in light of the potential importance of these PCS applications in serving as a catalyst for the widespread development of PCS services. Although the cellular carriers currently have some flexibility to provide such services on an incidental or secondary basis, the Commission's proposal for modification of the cellular rules will put the cellular carriers on an equal footing with PCS, and thereby expand customer choice and the availability of these important services.

C. Local Exchange Companies Must Be Able To  
Compete With New Technologies And Services  
For Their Existing Business

The Commission views PCS initially as a complementary service to local LEC wireline exchange, eventually expanding the role into a full-fledged competitor for this service.<sup>24/</sup>

Northern Telecom views the technology used to deliver PCS as a cost effective alternative to copper and fiber technologies, in many cases, for local distribution. As such, the LECs must be able to compete to retain their customer base on a "level playing

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<sup>24/</sup> NPRM at ¶ 71.

field." We believe the LECs must be allowed the opportunity in their existing franchise areas to obtain spectrum for the provision of wireless loops. To preclude the LECs from using new wireless technologies to provide their traditional services carries the risk of relegating the existing local service providers to technical, service and market obsolescence. Moreover, such artificial "competition" between wired and wireless carriers would only benefit the PCS carriers, not the public. Thus, regardless of the Commission's decision whether to allow LECs to obtain a PCS license in their territory (because of their cellular operations), the Commission must allow the carriers the opportunity to provide wireless loop service either through a limited license for the PCS spectrum, or through a separate allocation for such services.<sup>25/</sup>

V. TECHNICAL STANDARDS

A. A Combination Of Technical Regulations And Industry Standards Are Required To Support Current And Future Applications For PCS

The Commission is proposing a technical framework that it believes will permit significant flexibility in the design and

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<sup>25/</sup> In addition, because of their experience in communications, technical knowledge and billing systems, LECs would be able to offer PCS rapidly and efficiently. As a result, services would be available quickly and competition would be enhanced if the LECs were permitted to provide licensed PCS outside of their service areas. Thus, Northern Telecom supports allowing LECs to provide licensed PCS services. NPRM at ¶ 76.

implementation of PCS systems, devices, and services.<sup>26/</sup> The Commission believes that this flexibility will allow diversity and innovation into the market as PCS is developed. Although the Commission perceives a need for technical standards, the Commission also concludes that the efforts by industry standards committees to date (including T1, TIA, and IEEE standards bodies (e.g., T1P1, T1E1, TR45.4, IEEE 802.11)), along with numerous experimental licenses that have produced significant information about the service, makes it unnecessary for the Commission to convene an advisory committee at this time.

Northern Telecom agrees that implementation of PCS requires a fair measure of flexibility in design due to the immature and changing state of services and concepts, and the existence of incumbent users in the bands of interest. The public interest is best served by spectrum etiquette techniques that allow a maximum number of users and applications to exist in any geographic area, while providing a high grade of service and a minimum amount of interference, as well as air interface standards that provide portability between service providers. These capabilities can be provided without an impact on innovation.

Northern Telecom believes that flexibility must be a cornerstone of any Spectrum Management Methodology and Common Air Interface standards. Northern Telecom further believes that use

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<sup>26/</sup> NPRM at ¶ 105.

of non-standard interfaces will be detrimental to PCS growth in the United States due to fragmentation of the marketplace and the inability of users to easily move from one service provider to another without risk of technical obsolescence.

Northern Telecom agrees that a Commission advisory committee is not necessary at this time to develop the necessary standards. Northern Telecom applauds the work of the various industry committees to date, and will continue to participate actively in those processes. Northern Telecom urges the Commission to monitor these activities, and incorporate the results as necessary when addressing in the Rules the technical issues associated with any Spectrum Management Methodology or Common Air Interface standards. Direct Commission intervention in these industry standards setting processes should only occur if those efforts appear to the Commission unlikely to be successful or timely. Finally, the formal process of adopting the detailed standards should occur under the auspices of a recognized standards setting body.

Although the Commission preliminarily concluded that a formal Federal Advisory Committee was unnecessary, it still recognizes that there is a need for technical regulation in certain areas to prevent interference between PCS systems and existing microwave license holders. The Commission is

proposing operation [of unlicensed systems]  
in a region of the 2 GHz band that is  
relatively lightly loaded by fixed microwave  
operations . . . unlicensed devices will be  
subject to stringent power output

limits . . . [that] will ensure that existing microwave operations do not experience harmful interference from either licensed or unlicensed operations.<sup>27/</sup>

Northern Telecom agrees that some form of technical regulation is necessary to prevent unacceptable interference between adjacent PCS systems, and between PCS systems and incumbent fixed microwave users. Northern Telecom believes that such regulation is possible and feasible in the licensed bands. However, Northern Telecom concurs with a recent Telocator report,<sup>28/</sup> which concludes that unlicensed PCS devices cannot share spectrum with existing microwave systems, due to the inherent uncontrolled mobility of the PCS terminal devices (bearing in mind that the concept of PCS incorporates such mobility and ubiquity). As indicated previously, Northern Telecom therefore urges the Commission to allocate 35 MHz of spectrum for unlicensed PCS applications, with deployment to occur on a "phased" basis as segments of the unlicensed bands become clear.

Northern Telecom strongly believes that technical standards are required to ensure the ubiquity expected of PCS. The Commission should encourage standards that permit the same units to be used in both licensed and unlicensed applications -- cordless phone, wireless PBX, wireless CENTREX, public telepoint, and public residential access. The Commission should monitor the

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<sup>27/</sup> NPRM at ¶ 107.

<sup>28/</sup> "Telocator Analysis of Part 16 Sharing", Telocator PCS Technical & Engineering Committee, TE/92-5-28/40R2.



ongoing industry activities to ensure that the necessary standards are developed in a timely manner. If such industry standards setting processes appear likely to be unsuccessful, the Commission should revisit the advisory committee concept because of the importance of common standards amongst different PCS applications. Northern Telecom believes that the multi-application synergy from use of units across PCS services is an essential element for fostering the broadest and most economic development of PCS services in the most expeditious manner.

B. Interference And Coordination Guidelines  
That Allow Multiple Power And Distance  
Levels Will Encourage The Most Appropriate  
Installations In A Given Market

The Commission is very interested in preventing interference with incumbent microwave operations, and proposes for licensed PCS operations to use the coordination methodology and criteria for microwave radio systems enumerated in EIA/TIA's publication TSB10-E.<sup>29/</sup> The task of calculating the interference for each base station would fall on the PCS licensees.

Northern Telecom believes that with flexible geographic and frequency separation, and a spectrum management plan, licensed PCS operators and users can provide and receive service without affecting fixed microwave users. Northern Telecom also

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<sup>29/</sup> NPRM at ¶ 110.

recognizes that in some locations negotiations with incumbent users will be required to release sufficient spectrum for viable PCS deployment.

While in general Northern Telecom concurs that EIA/TIA publication TSB10-E provides a valuable basis to engineer coexistence/interference rules, we agree with Telocator<sup>30/</sup> that some "fine-tuning" of these rules is required to fairly protect both parties without unnecessarily limiting PCS access. Northern Telecom supports these efforts of Telocator and EIA to refine these rules for PCS.

The Commission proposes the TSB10-E coordination distance of 125 miles, given an antenna height of 295 feet and base power of 10 watts.<sup>31/</sup> The limitations were developed with the desire to not limit flexibility; however, they force larger coordination distances. We believe that most PCS operators and users will always be operating at transmission levels and antenna heights well below those proposed in the NPRM. We therefore believe that the coordination distances specified in the NPRM will create an unnecessarily onerous task on prospective PCS operators. These requirements would increase system costs to the low-power user without adding any extra protection to the incumbent users. We encourage the Commission to extrapolate the

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<sup>30/</sup> "Telocator Recommendations for TIA Bulletin 10 Improvements", Telocator TE/92-4-15/058.

<sup>31/</sup> NPRM at ¶ 117.

coordination distances to derive appropriate values for low-power (<1W) and low antenna (<15m) systems.

Northern Telecom concurs with the Commission's conclusion that bilateral arrangements on service area boundaries will adequately address this issue. Northern Telecom also observes that this process will be greatly simplified if CAIs are used in both areas. Finally, Northern Telecom believes that the proposed high power/antenna height rules, if adopted, may technically compromise or significantly complicate realization of the Commission's goals of universality, speed of deployment, diversity of services and competitive delivery.

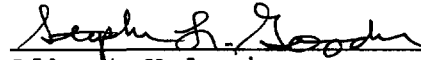
## VI. CONCLUSION

Northern Telecom strongly supports the Commission's efforts to move forward to enable PCS services to be offered in the market place, because the tremendous benefits of PCS will well serve the public interest. Northern Telecom believes that implementation of PCS will be best accomplished by the Commission allocating the spectrum and reducing regulation on current and future service providers. On a parallel track, industry associations are developing the necessary standards and spectrum etiquette techniques to ensure that PCS will become available in the widest, quickest and most efficient manner. Continuing

prompt action by the Commission will open the opportunities for end users to enjoy the benefits of PCS in the near future.

Respectfully submitted,

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## Appendix A

### Spectrum Management Methodology (SMM)

#### 1. Introduction

The Commission has indicated that Personal Communication Services (PCS) will have to share spectrum with existing fixed services in the 1.85 GHz - 1.99 GHz band, and that several personal communication services may actively be sharing the spectrum with each other.<sup>32/</sup> While clear, contiguous spectrum is obviously desirable, it is unrealistic to expect availability of clear spectrum for the near future. Therefore, it will be necessary to develop a methodology that will support sharing between PCS and the current licensees, as well as amongst PCS operators. It is also essential that a successful sharing methodology have the flexibility to support changes over time - including new services, changes in allocations, and regulatory changes. Northern Telecom believes that Spectrum Management Methodology (SMM) fully meets these goals for the licensed bands.

An important concept in SMM is the use of Common Air Interfaces (CAI) across public and private, licensed and unlicensed applications, in order to provide ubiquity and interoperability. Use of SMM should facilitate the rapid, cost-effective and spectrum-efficient deployment of common air interface(s) within the emerging technology bands. SMM is based on the philosophy of graceful coexistence of complementary licensed PCS and existing services with no forced displacement of the existing users (except as required by the Commission), rather than conflict and competitive coexistence. This philosophy fulfills the Northern Telecom understanding of the Commission's desire for fair treatment for incumbent microwave users.

An important feature of the proposed methodology is that it does not artificially constrain the development of service interfaces. This capability to accommodate change and evolution should stimulate technological innovation, provide system flexibility and "future-proofing" and be a keystone to support the development of the U.S. PCS industry.

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<sup>32/</sup> Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies, ET Docket No. 92-09, released February 7, 1992; Amendment of the Commission's Rules to Establish New Personal Communications Services, GEN Docket No. 90-314, ET Docket No. 92-100, FCC 92-333, released August 14, 1992.

## 2. Background

In order that the full potential of PCS be realized, it is essential that it be implemented in such a manner that provides North American ubiquity and roaming, as well as offer flexibility and low cost. These characteristics can be achieved via a small set of common air interfaces (CAIs).<sup>33/</sup> Moreover, the lack of "clear" spectrum, and uncertainty concerning future services and spectrum allocations, also provide a basis for the development of a flexible spectrum management methodology.

Spectrum flexibility is required to support:

- service growth and the addition of new, unforeseen services (e.g., FPLMTS, video);
- an allocation of additional spectrum by the Commission;
- future changes in spectrum allocation or use (e.g., as incumbent users migrate to other frequencies or technologies, or as the Commission progressively releases spectrum);
- regulatory changes in the competitive environment (e.g., an increase or decrease in the number of operators).

### 2.1 Proposed SMM Solution

The basic principles of the proposed SMM solution are:

- identify uniquely different service categories (e.g., voice, wireless LAN (10 Mb/s), satellite), where each service within the category is handled consistently and in an optimum manner, and with a common air interface for each category to provide full ubiquity and compatibility. Multiple CAIs for a category can also be supported, however. In addition, although the beacon control channels need to be specified so that they are consistent across systems, each PCS licensee retains the flexibility to dynamically allocate spectrum for the different service categories within the assigned band.

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<sup>33/</sup> See, e.g., "Cost Penalties of Multiple Air Interfaces" NTI contribution to Standards Committee T1P1, T1P1.2/92-049, April 1992.

- handle different categories in their optimum manner (without any requirement of consistency between categories), so as not to encumber unnecessarily different service categories with non-essential features. This also supports the "future-proofing" philosophy.
- avoid interference with existing users to minimize displacements of incumbent traffic. This is achieved by carefully controlling the frequency used (via beacon control channels) and transmit power of bases and mobiles. SMM thus supports slow, progressive, negotiated migration of spectrum from incumbent users to emerging technology users.
- establish a Commission (or Commission-authorized third-party) database of all existing microwave transmitter and receiver sites. Because no applications for new microwave facilities will be accepted by the Commission,<sup>34/</sup> the amount of fixed-microwave occupied spectrum will be either static or fall over time - it can never increase. The corresponding "potential PCS interference zones" will therefore also be either static or fall over time. Use of out-of-date information therefore should never cause interference to incumbent microwave users.
- licensed operators can regularly download current microwave transmitter/receiver locations to develop accurate PCS-permitted frequency/power "maps". This information is then transferred to specific radio bases for accurate control of mobiles, allowing usage in frequencies no longer used by the incumbent microwave users.
- use beacon, control channels to force a "listen-before-talk" (LBT) access protocol on all terminals using licensed bands (LBT should be a Commission license condition). Such a protocol will prevent inadvertent base/mobile transmissions on occupied channels, and permit flexible, local customization of permissible frequency and power - a capability that is essential if high-power mobiles need to operate in compatible low-power

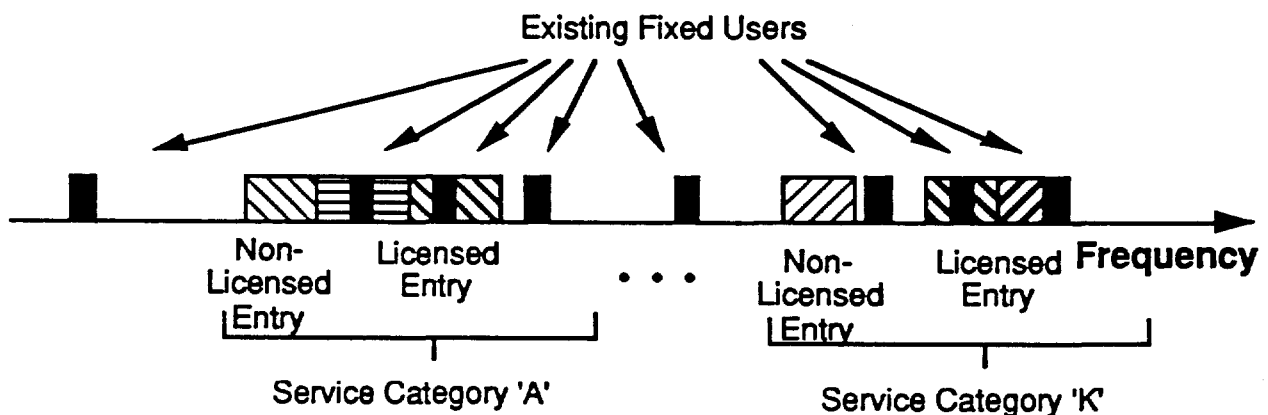
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<sup>34/</sup> "Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies", FCC, ET Docket No. 92-09, released February 7, 1992.

cells. This aspect will be particularly valuable where adjacent cells (from the same or competing operators) use different transmit powers due to differing cell sizes.

- regulatory or service changes require updating of the database of available channels in the base stations, there is no need to make changes to mobile units.

### 3. Public or Private Licensed Operation



**Figure 2.** Interleaved PCS and incumbent Allocations

While clear and contiguous spectrum is desirable, it is NOT required for this methodology and simply affects the PCS system capacity. As a consequence, licensed PCS services can be launched rapidly without awaiting the clearing of spectrum. SMM assumes that each service category (e.g., voice, wireless LAN (10 Mb/s), satellite) is allocated, by the operator, co-primary use of a block of spectrum (Figure 2) with the incumbent users.

SMM supports both exclusive and shared use of licensed spectrum. Exclusive use of spectrum permits auctioning of the spectrum by the Commission and encourages PCS operators to buy out incumbent microwave licensees within his allocation. On the other hand, exclusive use of spectrum implies some usage inefficiencies. This will occur where specific operator traffic does not require the whole allocation at specific locations, while competing operators may be overloaded. Because of the versatility of SMM,



however, its development can proceed without awaiting Commission resolution of these policy issues.

All operators providing like services within a service category should use the same CAI, whereas different service categories would (potentially) use different CAIs. This will offer the broadest PCS ubiquity, and permit use of a CAI for public and private licensed and unlicensed operations providing high cross-synergy. It is suggested (though not essential) that control channels occur only at specific frequencies (e.g., integer multiples of 5 MHz) to speed up the scanning process.

Operationally, the operator would download incumbent microwave transmitter/receiver frequency and location information at regular intervals from a centralized database (maintained by the Commission or one or more Commission-authorized third-parties), determine acceptable interference limits, and control the base stations (through alternative means such as a radio port controller). Since interference information is location-specific, the exact location of the base is required (e.g., from a portable GPS receiver used by the base installation crew). Terminals accessing a public personal communications system would scan for a suitable beacon access control channel, which would instruct the mobile as to which frequencies and power levels are permitted in the locality. The support infrastructure for this methodology (GPS receiver(s) and database(s)) is feasible for a regional or national public operator or multi-site private operator with minimal overhead costs.

The terminal-to-system acquisition process should scan all potential target beacon locations, searching for a suitable operator, or band of operation. Failure to acquire an operator could optionally trigger a call-setup attempt in a relevant, compatible unlicensed band.

#### 4. Conclusion

The methodology proposed here:

- permits rapid, efficient and flexible deployment of PCS radio technology without major constraints on future services;
- is "future-proofed" for changes in services, spectrum and market growth;
- allows slow, progressive, negotiated migration of spectrum from incumbent users to emerging technology users;